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October 31, 2016

Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, DC 20554

Regarding: Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions; Docket No. 12-268 and Public Notice: Incentive Auction Task Force and Media Bureau Seek Comment on Post-Incentive Auction Transition Scheduling Plan, September 2016, MB 16-306

Dear Ms Dortch,

Transmit Consultancy herewith submits its comments, relating specifically to the Public Notice (MB 16-306) requesting comment on the Post-Incentive Auction Transition Scheduling Plan.

We would welcome the opportunity to discuss our comments with the FCC and other interested parties.

Yours sincerely,

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**Before the
Federal Communications Commission
Washington, DC 20554**

In the Matter of)	
)	
Expanding the Economic and Innovation)	Docket No. 12-268
Opportunities of Spectrum Through)	
Incentive Auctions)	

To: The Commission

Comments of Transmit Consultancy

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Summary

Transmit Consultancy's ("Transmit") comments are based upon its recent experience of managing two repacking exercises in the United Kingdom and involvement with other European spectrum changes. Transmit presents its experience for consideration.

Transmit agrees that a transition plan must be phased; with stations assigned within those phases and the phases scheduled, and that the phasing and structure of the program should respond to the objectives and constraints of the program. We acknowledge the technical achievement of the phase scheduling tool and phase assignment tool but stress that their outputs must be considered the (strong) beginning of a transition planning process that will require human expert intervention to be refined and optimized to ensure the repack can be delivered on time, within budget whilst meeting the needs of all stakeholders. Only humans, experienced repack experts and spectrum-planning experts can take a pragmatic and "real world" approach to interference and transition planning – this cannot be built into software. We strongly propose that opportunities be taken to ease the program by embracing and proactively managing interference, and the transition planning process itself – transition planning is in effect a tool itself.

We strongly advocate – from our experiences on other repack programs - adopting a much more pragmatic approach to interference and planning (and with neighboring administrations). The FCC should consider assessing the shortest route through the repack program with the minimum linkage between stations. The objectives of the program are best considered as critical success factors and the constraints must be "real constraints". Strict aspirations to control the number of phases and the size of phases – whilst a good starting point - can artificially overcomplicate the repack.

Transmit advocates that for the repack to be successful the transition plan must be considered an iterative process – it is optimistic to think that the first channel re-assignment and transition plan will be fit for purpose to deliver the repack and the reality of the repack as its demands emerges. It is, therefore, essential that a "transition management team" leads a proactive and coordinated approach, that this approach has the consensus of the broadcast industry and that there are agreed mechanisms by which program and industry wide decision-making can be facilitated.

It is critical for the success of the reengineering program that "real constraints" are accepted (with broadcast industry consensus) and factored into the planning and implementation process (*i.e.*, bad weather, difficult geographical terrain, limited technical resources, complex engineering at individual and key stations) building in upfront contingency. Only by accepting these limitations up front can you begin to understand how to approach the Repack and unlock the challenges it represents.

A phased and coordinated planning and delivery approach to the complexities of this spectrum repack is essential. It is important to embrace that repack planning is an iterative process. It can only be done in this way. The planning of a repack is essentially a huge, multidimensional puzzle that evolves over time. Spectrum and roll-out planning needs continuous and integrated management through the life cycle of the program, and it needs to be able to adapt and evolve as the program becomes clearer - this is the real task of the "transition management team". Program strategy, structure and processes will need to be able to handle this iterative nature and feedback loops - this will be the norm not the exception.

That is not to say that such a "transition management team" makes a repack easy or that establishing such a team is easy – it is not! Stakeholder-wide backing and consensus; a mandate to manage and deliver; commitment by all involved to close trust gaps; and the people involved will determine the success of the Repack.

The best "transition management team" is a pragmatic team that can bring an unparalleled track record in successful delivery; unique insight and professional expertise to broadcast and repack infrastructure programs, focusing on deploying the right people with the right skills, thorough planning, realistic risk management and financial control, but with an overriding insistence on health and safety. A team that can plan and implement large scale critical national broadcast and telecoms infrastructure programs; whilst enabling cross-industry communication and forums in order to develop share and promote best practice wherever possible. A team that can coordinate the activities of specialist teams across all of the technical aspects of terrestrial broadcast networks - challenging convention, brokering reasonable compromise amongst experts, and enabling resolution of issues and successful outcomes. A team that can recognizing potential program risks and issues before others, proactively getting ahead of the risks and issues - enabling and coordinating early intervention.

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1. About Transmit Consultancy

Transmit Consultancy ("Transmit") is a team of broadcast TV experts, including business and technical expertise, headquartered in London and San Francisco, California. Transmit specializes in spectrum repacking projects, and has consulted in broadcast repacking projects across Europe, including projects like the FCC's upcoming incentive auctions. Transmit consults on and delivers big transformational broadcast projects, our genesis is spectrum repacking.

Together – working with broadcasters, the Government, the regulator, network providers and other Stakeholders – our consultants coordinated the end to end broadcast re-engineering program for two spectrum repacks in the UK to industry and political acclaim, under budget and on-time: leading unprecedented industry collaboration. In addition, our consultants have experience of broadcast TV networks and repacking projects in a number of countries outside the UK.

For both UK repack programs we worked using public money and both repacks impacted a comparable number of stations as this repack. The Government financed the 800MHz repack; it reimbursed broadcasters for costs incurred by them to complete the repack; the fund being administrated and managed by the regulator (Ofcom). The 1st (Digital TV switchover) repack was financed by a combination of commercial and public money – owing to the unique way that the BBC is funded. In addition, Transmit has unparalleled experience of repack transitions with complex spectrum interdependencies, daisy chains and cycles owing to the nations-wide (yet regionally sophisticated) networked nature of the UK's broadcast TV (it is widely acknowledged as one of the world's most complex broadcast TV platforms); the obligation to universally cover 98.5% of all households; and the geography of the UK (i.e. it is an island with many European neighbors).

Transmit consultants are currently consulting with broadcasters on the 3rd European repack of the 700MHz band. Previously, our consultants have consulted UK wireless operators launching 4G services at 800MHz on broadcast and wireless interference issues and management.

Transmit consultants have launched end-to-end broadcast TV networks, pioneering digital terrestrial TV (DTT) and HD broadcasting globally. Our consultants have launched and operated broadcaster shared multiplexes; set-up and managed the technical operations of both TV stations and broadcast TV platforms. We have chaired many Boards and industry committees, sat on Boards and committees; advised Government and Regulators on behalf of broadcasters; led industry wide teams; and played a role in international spectrum negotiations.

This is Transmit's fourth comment filing to the FCC regarding Docket No. 12-268 - see Appendix 3 for previous filings. For more information regarding our Management Team and Principal Consultants – our expertise and experience – see Appendices 1 and 2.

Transmit is pleased to bring its experience to inform the Commission's approach to the challenges and opportunities of the U.S. spectrum repack with an open and objective perspective.

<http://www.transmitconsultancy.tv>

2. Introduction and Summary

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It is critical for the success of the reengineering program that “real constraints” are accepted (with broadcast industry consensus) and factored into the planning and implementation process (*i.e.*, bad weather, difficult geographical terrain, limited technical resources, complex engineering at individual and key stations) building in upfront contingency. Only by accepting these limitations up front can you begin to understand how to approach the Repack and unlock the challenges it represents.

A phased and coordinated planning and delivery approach to the complexities of this spectrum repack is essential. It is important to embrace that repack planning is an iterative process. It can only be done in this way. The planning of a repack is essentially a huge, multidimensional puzzle that evolves over time. Spectrum and roll-out planning needs continuous and integrated management through the life cycle of the program, and it needs to be able to adapt and evolve as the program becomes clearer - this is the real task of the “transition management team”. Program strategy, structure and processes will need to be able to handle this iterative nature and feedback loops - this will be the norm not the exception.

That is not to say that such a “transition management team” makes a repack easy or that establishing such a team is easy – it is not! Stakeholder-wide backing and consensus; a mandate to manage and deliver; commitment by all involved to close trust gaps; and the people involved will determine the success of the Repack.

The best “transition management team” is a pragmatic team that can bring an unparalleled track record in successful delivery; unique insight and professional expertise to broadcast and repack infrastructure programs, focusing on deploying the right people with the right skills, thorough planning, realistic risk management and financial control, but with an overriding insistence on health and safety. A team that can plan and implement large scale critical national broadcast and telecoms infrastructure programs; whilst enabling cross-industry communication and forums in order to develop share and promote best practice wherever possible. A team that can coordinate the activities of specialist teams across all of the technical aspects of terrestrial broadcast networks - challenging convention, brokering reasonable compromise amongst experts, and enabling resolution of issues and successful outcomes. A team that can recognizing potential program risks and issues before others, proactively getting ahead of the risks and issues - enabling and coordinating early intervention.

3. A proactive and coordinated approach to transition planning and delivery

A phased and coordinated planning and delivery approach to the complexities of this spectrum repack is essential. This repack program is complex because diverse and disparate components (the auctions, broadcasters, engineers) act both independently yet in doing so make decisions that interact and impact each-other, and that those decisions evolve over time. The result is a program that is complex because it is adaptive and emerges over time. It will be difficult to understand and manage. The characteristics and behavior throughout this repack program will not be understood by looking just at individual components.

To not embrace this complexity risks program wide chaos. To deliver this large, complex, ambitious and unprecedented repack on time and within budget (as legally required and commercially important) requires a phased and coordinated planning and program management approach. The alternative risks a repack program that is uncontrollably late and over-budget, and that cannot be communicated effectively because it is not understood. Such a scenario would have diminished benefit to the public; be disruptive to the FCC, the fund administrator, broadcasters and mobile carriers; whilst being wasteful – it is also avoidable.

Quite simply, the administrator of the Broadcaster relocation fund will not be able to properly and efficiently distribute the \$1.75 billion fund without the understanding, planning, program managing and coordinating the spectrum planning, the strategy for program delivery, the engineering works, and the cutover timetable itself.

The challenge in a complex repack program is that making good decisions is difficult, motivating action is hard, aligning action and activity is exhausting, adaptation to unforeseen and external events is arduous; fostering coordination is challenging. To proactively put transition coordination at the center of this repack program is the only way to begin to unlock and hope to manage these challenges. Without a dedicated planning and coordination team challenges become ever more challenging; a coordination team – with a mandate to do so - can prioritize collaboration and simplification through industry agreed principles and rules. In addition, critical to success are people and relationships. The greatest software, robust and best practice processes and procedures – whilst necessary - don't delivery repack programs; individuals, teams and relationships do.

A successful delivery of this repack, will require a national view and the ability for decisions to be made for the greater good of the program – cutting through the politics and logistics, when priorities are competing and contradictory, alone will be an immense and specialized task. To set this repack up for success requires – without doubt – that the complexities be embraced; that relationships be managed proactively; that the planning and delivery be phased and coordinated by a team central to the program, the FCC teams, and the administrator of the \$1.75 billion broadcaster reallocation fund.

This proactive and coordinated approach is critical to ensure the publically announcement cutover dates are true and secure. This is how you effectively manage the risk out of the public announcement of cutover dates. A clear, attainable and secure public timetable is critical so that the viewing public, the FCC political stakeholders and media can have confidence in the process.

4. A pragmatic and “real world” approach to interference & planning

We strongly advocate – from our experiences on other repack programs - adopting a much more pragmatic approach to interference and transition planning (and with neighboring administrations). The FCC should consider assessing the shortest route through the repack program with the minimum linkage between stations. The objectives of the program are best considered as critical success factors and the constraints must be “real constraints”. Strict aspirations to control the number of phases and the size of phases – whilst a good starting point - can artificially overcomplicate the repack.

Repacks are from an engineering perspective iterative in their planning, design and implementation. Reengineering broadcast TV networks is a multi-dimensional puzzle with complex interdependencies. Technical decisions made by one participating broadcaster can impact multiple other decision points and broadcasters. As a result unified high-level, over-arching spectrum and engineering design/planning needs to be iterative with continuous feedback loops to ensure the most robust broadcast solutions are reached and the rollout timetable is optimized. Structures and processes will need to be able to handle this iterative nature and feedback loops both within individual broadcast companies and between broadcast companies – and of course the FCC itself. This will be the norm not the exception. A “transition management team” can facilitate, manage and mitigate iterations and feedback between parties – without this approach the repack program will falter, even fail.

It is critical for the success of the reengineering program that “real constraints” are accepted (with broadcast industry consensus) and factored into the planning and implementation process (*i.e.*, bad weather, difficult geographical terrain, limited technical resources, complex engineering at individual and key stations) building in upfront contingency. Only by accepting these limitations up front can you begin to understand how to approach the Repack and unlock the challenges it represents. The restrictions and limitations the Repack faced must be understood in the planning stage, solutions must be proactively found upfront, and if no solution can readily be found then potential mitigation techniques and options understood and agreed across the industry with the FCC at the very beginning of the project.

Whilst recognizing the official interference predictions based on modeling, permitting higher levels of interference for limited periods of time on the basis that it is unlikely that those levels of interference will actually occur or be noticed allows smart breaks in the spectrum interdependencies (daisy chains) and can give greater flexibility within the program. For example, in the UK coverage is predicted to 100m pixels, a pragmatic, more relaxed and “real world” approach to coverage was taken to great value and benefit to the program. The in USA, such large (multi-km) prediction pixels create difficulties due to the granularity of the model. The opportunity here – owing to the (lack of) granularity of the model – is that a pragmatic, more relaxed and “real world” approach would result in greater value and benefit to the program. Only humans and spectrum planning experts can take a pragmatic and “real world” approach to interference – this cannot be built into software.

We strongly propose that opportunities be taken to ease the program by embracing and proactively managing interference. Yes, tools such as parking channels can be considered expensive, extra steps in the repack but they are one of the most valuable tools to breaking the interdependencies within the repack. Parking channels should be considered a mechanism to park sections of the repack out the way to enable other parts of the repack to proceed. With this perspective, coordinated transition management can use parking channels to minimize overall program time, costs and impacts to broadcasters and the public.

As a result, we propose a pragmatic and “real world” approach to interference is taken as interference is usually less than modeled or it appears, including:

- Permitting extra (over the 1%) inter-station interference for a short period (say two weeks) to facilitate testing and ease the transition, and permitting extra interference at times of low viewing (e.g. overnight) to permit stations to decouple their testing from each other.
- That whilst parking channels are undesirable due to the increase in engineering work and complicating the consumer message, they should be used judiciously to reduce the risk of having so many stations linked together.
- Using phase/regional delays to break the program links, i.e. to “park” stations on their current channel.
- Being open to using released spectrum to ease & advance the repack program in other/adjacent areas - prior to handing over to the mobile operators.

5. What is a proactive & coordinated approach to transition management?

The task/work stream is to assist the FCC to enable the completion of the broadcast re-engineering program to repack the band, releasing the required spectrum in the required timeframe and on budget. All whilst ensuring that coverage does not decline in population further than agreed parameters; that the timetable can be flexible to broadcasters; that disruption to viewers is minimized, that resources are used efficiently; that deadlines respect the individual circumstances of broadcast stations; and that the needs of the auction winners and their construction are accounted for.

A “transition management team” should be responsible for coordinating the broadcast industry (broadcasters and supply chain) in accordance with FCC requirements, the planning, co-ordination, rollout and implementation, and direction of the US repack program, to deliver the program on-time, within budget whilst also meeting coverage impact obligations and all other responsibilities within the Spectrum Act. The “transition management team” should be considered a program management function across the technical planning, the re-engineering build, and staggered roll out of the cutover timetable required to repack and release spectrum. Further, to provide technical liaison, briefings and technical issue resolution across all other repack work streams, and to provide expert input into policy and processes specifically relating to the technical aspects of the Repack program. Essentially, it should manage the transition program up and into the FCC and Government, and the transitional repack program into and with the industry - obviously working very closely with the wider management of the financial and political programs – each informing the others.

In previous comments to the FCC on docket 12-268 (see appendix 3), Transmit proposed a program management function for the transition of the repack and that it should be established as soon as possible in order to maximize the benefits of a collaborative approach and to minimize the risks associated with fragmentation of the project. Regardless of whether this task is acknowledged at the start of the program the task itself will be required. Quite simply, the administrator of the relocation fund will not be able to properly and efficiently distribute \$1.75 billion without the understanding, planning, program managing and coordinating the spectrum planning, the strategy for program delivery (technical), the engineering works and the cutover timetable itself. This is the key tool to enabling risk and issues to be managed throughout the program and out of the program.

The band plan order published by the FCC that kicks this program off should be considered an end state goal. It will not be exactly the plan that is delivered because that is not possible (one key reason is international spectrum coordination will change the plan over time). But mostly importantly, the technical success of this program lies in how you manage the transition from today’s spectrum plan and the infrastructure of all transmission sites through the re-engineering process and transitional spectrum states to the end repacked spectrum plan. The spectrum band plan itself will need to be understood and managed against time against a series of standardized milestones, these milestones being each spectrum state change. It is also critical that this can manage this through various program and project lens - i.e. station level, market level, regionally and nationally. This is a big job, it will require spectrum planning resource and broadcast infrastructure experts within the “transition management team” and much liaison with broadcasters and the FCC team. It requires experienced and expert repack project managers.

Therefore, it is important to embrace that repack planning is an iterative process. It can only be done in this way. The planning of a repack is essentially a huge, multidimensional puzzle that evolves over time. Spectrum and roll-out planning needs continuous and integrated management through the life cycle of the program, and it needs to be able to adapt and evolve as the program becomes clearer - this is the real task of the “transition management team”.

Whilst the end state band plan may absolutely be the true end state, it is the allocation of which stations on which spectrum which may need refinement to ensure the program is possible at all and can be delivered from an operational broadcast perspective. As coverage interactions emerge; international interdependencies play out; the engineering requirements at individual stations become clear; and political factors develop the transition planning process and the plan itself will need to be able to respond accordingly. In addition, defense of the channel reassignment algorithm and end-state plan into and with the industry will be a huge stakeholder management challenge – optimum protection of the repack end state spectrum plan is critical, management of change will be required but must be proactively managed to the optimum level.

The following are the delivery areas & work stream activities of a transition management team. Along with stakeholder management, progress and exceptional reporting, oversight and steering, point of authority information management, collaboration, decision-making, risk and issues management & mitigation across all key deliverables – for fully integrated planning and delivery.

- **Frequency plan development & management:** to protect, manage & evolve the repack end state spectrum plan, designing the transitions required to deliver this end state - whilst protecting 99.5% coverage at each station.
- **International co-ordination of the frequency plan:** to help facilitate coordination with Mexico and Canada on spectrum usage to maximize USA coverage, making recommendations into the repack program to mitigate international issues.
- **Translation of the frequency plan into an operational transmission infrastructure:** to provide oversight that the required broadcast characteristics (for example, spectrum allocation, domestic and international interference considerations) are being met by the site design, ensuring that site specification delivers permitted transmission patterns and that the infrastructure delivers the required coverage with the most appropriate solution. This is the review & assessment of the technical specifications within the TV Broadcaster Reimbursement Fund Reimbursement Form (FCC Form 2100, Schedule 399).
- **Channel re-assignments:** defense of the channel reassignment algorithm, protection of the repack end state spectrum plan, and management of any change required to the Channel Reassignment PN. Change must be proactively managed to the optimum level.
- **Technical principles for the repack:** development of a principles based approach to technical decision making - single source of truth.
- **The re-engineering works (build and roll-out):** program management of the re-engineering works within the 36 - 39 month transition period and \$1.75 billion.
- **Repack cutover timetable:** co-ordination of a staggered regional roll-out plan for cutovers within the 36 - 39 month transition period - informed by bottom up technical planning. Dates only publicly announced when technically de-risked.

It is important to state that we are not talking “big project management” here. We very much advocate project management by exception - there is no intention to be amongst any broadcasters’ day-to-day project activities. However, the scale, complexity and timeframe of this program do require a coordinated approach to the repack as a program if it is to be successful.

The best “transition management team” is a pragmatic team that can bring an unparalleled track record in successful delivery; unique insight and professional expertise to broadcast and repack infrastructure programs, focusing on deploying the right people with the right skills, thorough planning, realistic risk management and financial control, but with an overriding insistence on health and safety. A team that can plan and implement large scale critical national broadcast and telecoms infrastructure programs; whilst enabling cross-industry communication and forums in order to develop share and promote best practice wherever possible (particularly in the field of Health and Safety). A team that can coordinate the activities of specialist teams across all of the technical aspects of terrestrial broadcast networks - challenging convention, brokering reasonable compromise amongst experts, and enabling resolution of issues and successful outcomes. A team that can recognizing potential program risks and issues before others, proactively getting ahead of the risks and issues - enabling and coordinating early intervention.

6. The importance of “consensus-based” coordination and transition management

Transmit believes that a coordinated approach to the repack is essential but that it also must be consensus based – that consensus being with the broadcast industry. The public interest will best be served by enabling participating broadcasters to minimize the impacts of this potentially disruptive event on their businesses and to participate in the repacking process in a commercially sophisticated manner. While it is undoubtedly true that “broadcasters are very experienced at channel moves and technology transitions” there is no apparent history of the level of industry co-operation and co-ordination required to successfully achieve this re-pack transition without undue disruption to services and to viewers. This is because there has never previously been an attempt made to implement changes of such a widespread and interdependent nature, and as you repack broadcast into less spectrum the challenges become more complex.

Industry co-ordination is required from pre-planning to implementation to ensure the efficient and timely deployment of limited resources across a US wide project; a project which must address and carefully balance the overall objectives of the repack with the priorities of individual stations.

A “transition management team” can be tasked to maximize – as appropriate and feasible - the economies of scale and the efficiencies available from industry co-ordination. It should be established as soon as possible in order to maximize the benefits of a collaborative approach and to minimize the risks associated with fragmentation of the project. Transmit’s experience of building unprecedented and unparalleled levels of co-operation and collaboration between rival broadcasters in order to manage re-packing exercises proves that there is real value to this approach – value that gains momentum and grows through the program.

Industry collaboration and coordination, however, must be built on a consensus basis. Broadcaster collaboration and coordination can be valuable in developing innovative ways to save program costs, optimize the use of scarce resources and deliver pragmatic solutions. A mechanism designed to facilitate, at an industry level, broadcaster collaboration and coordination to deliver a repack can greatly increase the chances of program success but ideally it should emerge from the broadcaster players themselves.

It is critical that the broadcast industry be given every opportunity to minimize the impacts of what is essentially a disruptive event on their businesses and that participating broadcasters are enabled to approach delivering a project with a public purpose in a business minded and commercially astute manner. The purpose of this coordinated approach being essentially to facilitate, consolidate and proactively manage the repack transition for and with the industry.

7. The importance of “principle based” coordination and transition management

Every what, why, how and when of a repack can and will be challenged by stakeholders. Decisions will need to be made broadcast industry wide, and program decisions and policy defended over time. Broadcasters will have very different agendas and objectives from the repack, yet all broadcasters must be treated with parity, and decisions need to be consistent and stand up to scrutiny. Therefore, a principles based approach – to both the repack transition and its cost reimbursement – is critical to success.

In the simplest of terms by “principles-based approach” we mean that all that can be done is done to proactively agree across an industry how elements, issues and challenges of the Repack will be dealt with upfront – you are effectively designing the decision making process upfront. Of course, not everything can be foreseen but that makes it even more important to address upfront the known issues. By adopting a principles based approach, decisions are made proactively about how elements, issues and challenges are to be approached, and importantly the tools and options available are identified and agreed. This then, enables the industry to focus on the un-foreseen issues and challenges that will inevitably arise as the Repack program rolls.

A principles-based approach can be used to attain industry clarity and consensus on key technical matters, making clear options available to participating broadcasters and providing transparency to the decision-making processes when the repack is under way. It is critical that participating broadcasters are involved in and engaged with the design of the governing principles. Such an approach can greatly ease the management of the Repack Broadcaster Reimbursement Fund and expedite the repack implementation. In this way, the volume of technical principles open to debate is contained and participating broadcasters may work within a set of network re- planning principles and tools to gain confidence that the costs associated with their approach will be reimbursed.

For example, principles can be used for clarity on the criteria for replacing and/or modifying antennas; processes for exchanging spectrum between stations, engineering techniques (that are reimbursable) for regaining coverage lost as a result of the repack; acceptance of trade-offs between cost and the speed of delivery; pragmatic issue resolution that avoids delay (including use of mediators); and the treatment on on-going incremental costs (i.e. additional electricity costs associated with moving to a higher-powered transmitter). Setting clear principles for cost reimbursement and transition management in advance of the start of the project is critical since otherwise participating broadcasters are unlikely to commit to the plan.

A transition management team can play a key, proactive and leading role in setting up and agreeing with the industry such principles; they can then implement and adapt them – with the industry – as the repack program emerges and rolls. Such principles can be considered a great vehicle for creating transparency, certainty and trust across the program and industry – in essence, they make it easier for all to work together.

8. Key reasons for the proactive coordination of transition planning & delivery

With collaboration, coordination and proactive management, transition planning can be de-risked and opportunities leveraged – for example:

a) Expedition of the launch of new mobile services in critical markets.

A phased, proactive and coordinated approach is the most effective way to ensure that spectrum is released in a prioritized manner. It can also accommodate broadcasters requirements in some difficult areas (e.g. areas along the borders of Canada and Mexico) without progress in priority markets being impeded.

Without central co-ordination it will be impossible to communicate to auction winners the timetable for their spectrum becoming available.

b) Managing the \$1.75 billion budget and industry-wide decision making

In the absence of careful co-ordination it will be extremely difficult to ensure that the overall cost of the program remains within budget and that any prioritization of funding meets all the objectives in a fair and reasoned manner with parity across broadcasters. Setting clear principles for cost reimbursement in advance of the start of the project is critical since otherwise participating broadcasters are unlikely to commit to the plan.

Examples of planning, engineering and implementation factors where coordination is critical for successful fund administration:

- The acceptance of trade-offs between cost and the speed of delivery;
- The ability for participating broadcasters to manage change within their budget;
- Transparent and consistent reporting of decision-making to the industry;
- How channels are allocated to participating broadcasters, and how exceptions are handled when complex spectrum interactions require allocations to be revisited;
- The criteria for replacing and/or modifying antennas;
- How international requirements and agreements are handled;
- The criteria for replacing or retuning transmitters;
- The process for exchanging spectrum between stations;
- Synchronizing cut-overs in markets and regions to maximize benefits to the public and mobile operators; and
- Band-edge handling to guard against interference with mobile use.

Without coordination of the technical planning, re-engineering and delivery approach it will be impossible to ensure the program is delivered on time and within budget. It will also be extremely difficult to understand and communicate the status of the program through out. This alone will create reputational issues for the program, and risks jeopardizing the program itself – at worse the risk is litigation.

c) Managing the cost and size of the broadcaster reimbursement fund

A phased and coordinated approach to technical planning, re-engineering works and cutover delivery is critical to set the broadcaster reallocation fund administrator up for success. To consider this approach excessive and expensive is false logic. Without a phased national cutover plan that all broadcasters, stakeholders and the supply chain are committed to and working towards it will be impossible to predict, control and manage the workflow within the repack.

The alternative is a repack that has to react to peaks and troughs in activity and demand as progress is being controlled by broadcasters. The peaks will be expensive to manage; the peaks and troughs risk the program being late.

d) Program complexity & optimism bias

A phased and coordinated planning and delivery approach to the complexities of this spectrum repack is essential. This repack program is complex because diverse and disparate components (the auctions, broadcasters, engineers) act both independently yet in doing so make decisions that interact and impact each other, and that those decisions evolve over time. Ultimately, a repack is complex because stations' repack story is directly affected by the story of adjacent stations, the engineering and spectrum interdependencies – daisy chains and cycles. The result is a program that is complex because it is adaptive and emerges over time.

With increased program complexity comes the reduced probability of a successful outcome. Without a proactive and coordinated approach from the beginning, the program's complexity will increase unnecessarily.

Realistic program contingency (cost and time) is essential. It is critical for the success of the reengineering program that limitations are accepted and factored into the planning and implementation process (*i.e.*, bad weather, difficult geographical terrain, limited technical resources) building in upfront contingency. It is only by acknowledging that there are resource problems; that many transmission sites can only be worked on for narrow periods of the year (for terrain and/or weather reasons); that working in areas that trigger environmental and/or historical or tribal consultations will cause delays; that negotiations with 3rd party site owners and multitenant towers will be difficult can a Repack be successful. In fact, only by accepting these limitations up front can you begin to understand how to approach the Repack and unlock the challenges it represents.

Be aware of optimism bias, so often complex programs of change are designed around notional or average expected stage durations with inadequate allowance for unexpected or uncontrollable events.

A "transition management team" can embrace complexity at a program level, and work to elevate its impact. For example, a "transition management team" can proactively plan realistic program contingency from the beginning; ensure expert analysis of all systematic and specific risk factors via established technique to derive appropriate time and cost contingency targets; balance the requirements for stage completions to be "on time" with the opportunities to permit early stage completions.

e) Program confidence requires a clear, attainable and secure public timetable

A complex repack should only announce cutover dates to the public when work is sufficiently far advanced to give confidence that those dates can be met – this de-risked approach is politically invaluable. If transition management is coordinated an emerging date announcement process can also be used to alert the viewing public to the date and time on which their viewing habits may be impacted. In addition, the management of technical and communications plans in parallel can greatly facilitate the accurate and timely communication of technical changes and can even be used to drive spectrum planners and engineers to minimize viewer impacts in their planning.

For example, in the UK, the technical transition planning was iterative locking down dates as the plan involved, quarters to months to actual dates. In parallel, we announced - for any given station/group of stations 1st the year of cutover, then the half year, then quarter, then month, then actual date - again this can be considered an industry agreed and coordinated principles based approach. For example, announce the month 6 months out once all air works is complete - i.e. no risk in the antenna works; announce the date 3 months out post all system testing i.e. engineering is complete and technically cutover is now possible. (note, timeframes for this repack would probably be shorter). In exceptional circumstances this approach also has the benefit of being able to shift actual cutover dates within the window of time that has been announced.

f) Protection of high profile/ high revenue events (i.e. US election, sporting events)

Coordination is required in order that high profile/ high revenue events are protected from disruption caused by the repack – both re-engineering works and cutover. In the UK, Digital TV Switchover and the 800Mhz repack took place during 2012. Considerable dexterity in the planning phase ensured that there was no detrimental impact on the 2012 Olympics coverage. Co-ordination also ensured key markets completed cutover prior to the Olympics. In early 2012 political opinion shifted and broadcasters were asked to complete Digital TV Switchover in all markets prior to the Olympics. It took significant industry coordination to bring the back end of the program forward by months – mitigating and controlling the risk involved - and it was only achieved by the collaboration and coordination that had been built through the program.

Without coordination excessive protection of events may occur blocking out too much time in the program. Coordination will also enable the program to respond to events and changes in political opinion to events throughout the program.

g) Managing radio and mobile operators through re-engineering works

Proactive and early engagement with the radio and mobile industry is essential. It cannot be assumed a mobile operator will cooperate throughout the repack reengineering works simply because it won spectrum in the auction. Nor can it be assumed that a radio station, even if owned by the same broadcast corporation as the TV station on the tower, will cooperate. Early and consistent engagement with the radio and mobile industries is critical to agree principles for – the inevitable - impact to their services as a result of reengineering works. Most importantly, this approach can ensure that requests for compensation for interruptions to service and/or coverage impact during the repack reengineering gain no traction.

The alternative is a heavy cost for compensation, and at worse litigation.

h) The smart use of engineering techniques and interference mitigation

If broadcasters are working together in a collaborative and coordinated way then the spectrum band plan, engineering works and cutover timetable can be proactively and iteratively designed, phased and refined to minimize time, costs and impacts to broadcasters and the public. Collaboration to achieve innovative problem solving is one of the great opportunities of the repack; with such collaboration transition planning really can be a tool – in itself - to minimize time, costs and impacts to broadcasters and the public. The alternative is a repack that is more expensive than it could be, and more sensitive to resource and manufacturing scarcity issues.

Some examples of engineering opportunities available through coordinated collaboration:

- **Minimizing the number of channels each station is shifted** in the repack band plan will reduce costs significantly. The fewer channels a station moves the more likely its antenna can be modified and still meet coverage objectives; the more likely and less expensive it is to retune the transmitter.
- **Stacking of cutover dates to mitigate spectrum and coverage issues**
The stacking of cutover dates (that cutover dates in a market / region are scheduled to occur on the same dates, even with a set time window (i.e. early hours of the morning)), is primarily advised to mitigate spectrum and coverage interactions between adjacent sites (i.e. potential losses of TV services during the repack transition can be planned out of the program and this de-risked) and ease program date communications to viewers. Stacking can be used to “plan” interactions out of the transition plan; it can be an effective technique to remove some interactions completely. In addition, the stacking and coordination of cutover dates in markets and regions does mean that you can schedule groups of cutovers around high profile events easily. It also has the added advantage that you can move the cutover dates for potentially whole markets and regions together should it become required (without having to re-understand spectrum interference issues) – i.e. the Olympics example given previously.
- **Re-use of existing infrastructure**
Major cost savings can be achieved through the widespread re-appraisal and re-use of existing equipment - antennas, feeders, towers (often strengthened and/or extended), combiners, transmitters (re-tuned), buildings (refurbished and/or extended), and power supplies – across broadcasters. Creating a market to re-appraisal and re-use existing equipment requires coordination and can be brokered and aligned by a transition management team. During the UK’s first repack the re-use of existing infrastructure across broadcasters and stations delivered an overall cost saving of 10% of the total cost of the repack re-engineering.
- **Mitigating interference between stations, managing daisy chains and cycles**
Interference between adjacent stations, as a result of the repack, will need to be managed and mitigated. Interference can be mitigated and managed using spectrum planning and engineering techniques – for example, power levels changed, filters added and/or antennas modified. Costs to manage interference between TV stations can be decreased by agreeing up front the principles by which engineering techniques can and should be used. In addition, early recognition and mitigation of coverage issues caused by the repack will create a more robust solution and in the long term be cheaper. Designing antenna and transmission systems to mitigate interference requires an iterative and coordinated planning approach because by definition it is all about interdependencies. The later solutions are sought to mitigate coverage and interference issues the more expensive they are – technically robust and cost efficient solutions need to be designed into the re-engineering early and this requires collaboration from all stations involved. If station interference is not managed as is required then the repack program will detrimentally affect some viewers – essentially knocking them out of broadcast TV service.
- **Sharing transportable transmitters** can reduce re-engineering scope, costs and waste while keeping participating broadcasters on-air during the repack. A transportable transmitter is a transmitter (or set of transmitters) in a container that can be moved around the country. Transportable transmitters can be used to take the existing permanent transmitter(s) out of circuit; existing broadcasts use the containerized transmitters while the existing transmitters are replaced or retuned ready for the repack. The use of containerized transmitters can also eliminate the need for building works to accommodate transitional equipment. Transportable transmitters could be shared nationally, regionally and/or within broadcast corporations. The greater the coordination and sharing of transitional equipment the greater the savings

and the lower the waste.

- **Using a 2 step process to repack**

The benefits of a two-step repack are the fewer channels a station moves the more likely its antenna can be modified and still meet coverage objectives; the more likely and less expensive it is to retune the transmitter. In the UK for the 800MHz repack, all stations on channels 61 and 62 were shifted to 48 to 53, and some stations using channels 48 to 53 were shifted to 39 to 40. A two-step repack does require central coordination of planning and implementation. The lower spectrum shifts must happen first so that the upper shift is possible.

- i) **Ensuring broadcast transmission continuity and the protection of station coverage through the transition.**

A phased, proactive and coordinated approach increases confidence in the relocation process, projected costs, and the program, generally. The complexity and limitations of this repack also means that a proactive and coordinated approach might be the only way to endeavour to meet the 3 year transition period given that spectrum and resources are scarce, and spectrum interdependencies complex.

Proactive and coordinated planning enables engineering and spectrum management based tools to be used to ensure seamless on-air transition with consistent coverage during the transition - minimizing the time broadcasters spend in expensive transitional states.

- j) **Managing scarce engineering resource and the manufacturing supply chain**

It is widely appreciated that mast riggers, transmitter retuning experts, combiner retuning experts and helicopter pilots qualified to replace antennas are a scarce resource. Global manufacturing capacity – transmitters, antennas, combiners etc. – is also widely accepted as limited, with a ramp up required to meet this repacks peak in demand. In addition, without coordination the buying power of the TV industry and repack program is being discarded. Bulk discounts can be achieved by centrally negotiated framework agreements - based on aggregated predicted demand. This then allowed individual companies to draw down individual items and resources at the discounted and locked in price.

There is a significant risk that resource providers are likely to see opportunity leading to major cost escalations, lack of flexibility (time and innovation) and the increased use of less skilled and inadequately trained personnel. We would propose importing critical skills and resources from trusted international contacts, and establishing and enforcing experience levels for all labor. In addition, we would advocate the early agreement of labor rates to hedge uncontrollable rate inflation – especially if and when delays occur.

It should also be noted that repack engineering resource is scarce globally. Consideration should be given to likely concurrent demands on said critical skills/resources from similar programmes worldwide, possibly negotiating adjustment to the phasing of the repack (or other competing programmes). A phased and coordinated repack can respond to and better manage the scarcity of expert engineering resource and transmission equipment – and together, controlling costs and ensuring that valuable resources are not wasted.

The alternative is a repack that is late and expensive owing to resource and manufacturing scarcity issues being ignored; those in control of the supply chain would dictate the repack timetable and cost.

9. Real examples of the need for proactive coordination of transition planning & delivery

a) Political opinion on acceptable timelines for key markets can change

- In the UK, a large percentage of Digital TV Switchover & the 800 MHz repack cutovers took place in 2012 - The London Olympics year.
- It was originally agreed with Government & Ofcom that London would cutover after the Olympics (to minimize risk).
- In addition, it took considerable dexterity in the planning stage to ensure there was absolutely no impact to Olympics broadcasting nation wide.
- In early 2012, political opinion shifted and the program/broadcasters were asked to complete Digital TV Switchover in all markets prior to the Olympics - this request came directly from the UK Prime Minister.
- It took significant industry coordination to bring the back end of the program forward by months - mitigating and controlling risk involved - it was only achieved by the collaboration & coordination that had been built through the program.

b) Radio & mobile operators can rally together to refuse to accept service impacts during repack re-engineering works, may also seek compensation

- In the UK, the radio industry did not want to accept any service impacts during repack re-engineering works.
- For example, a radio station's broadcast may need to be turned down or even off for a period to ensure the working conditions on the mast are safe for the contractors.
- Note: it cannot be assumed that mobile operator will cooperate throughout the repacking works simply because it won spectrum in the auction. Nor can it be assumed that a radio station - even if owned by the same broadcast corporation as the TV station on the tower - will cooperate.
- Early, proactive & consistent engagement with the radio & mobile industries is critical to agree principles for - the inevitable - impact to their services.
- Most importantly, in the UK, this approach ensured that requests for compensation for interruptions to service and / or coverage during repack reengineering did not gain traction.

c) Releasing & repacking spectrum in border areas will be driven by relationships with Mexico & Canada

- In the UK, we had to negotiate the handing over of spectrum with our neighbors. We could not plan spectrum moves or schedule cutover dates without agreement with these neighbors.
- With France, the cutover plan for all key markets on the South Coast, and The Channel Islands had to be coordinated with the French plan. The plan could only be made to work with the use of temporary/transitional parking channels i.e. both countries borrowed spectrum off each other to enable the complex spectrum transitions to be made.
- With the Republic of Ireland, the UK technical team helped to plan the Irish transition - to ensure it enabled both repacks together. This level of cooperation was brokered through the regulators and "sign-offs" made at a Ministerial Political level.

d) Equipment installations fail

- Crystal Palace is the UK's most complex & important transmission site as it serves London. During the testing of the new (antenna) feeders moisture was found in the feeders, which required their replacement.
- Normal ordering & procurement processes would have been disastrous i.e. re-engineering program would have been significantly delayed, and it would have been highly likely that the station was unable to hit the scheduled cutover window/date.
- Broadcasters worked together to re-prioritize all relevant manufacturing in progress at the time to ensure that Crystal Palace production was the number 1 priority.

e) Antenna designs & specifications take time, and CTO/Senior Management will not rush strategically important technical infrastructure decisions

- Early in the antenna/transmission & site specification & costing process (equivalent to the "processing payments work stream") almost all documentation/forms submitted by broadcasters (and suppliers) were late and all key milestones were missed. This was against a process and schedules agreed with and by the broadcasters.
- 2 key factors were at play here a) all had underestimated the trade-offs between cost and time that required discussion and agreement and b) the decision makers would not be rushed into decisions that were strategically - both commercially and technically - important.
- At first we attempted to control and force the process forward but in reality this simply was not allowed to work by broadcast organizations i.e. assuming automatic sign-off at the deadline was not accepted by a CTO who had to take critical decisions to his Board for approval.
- We only solved this problem and got the "processing payments work stream" manageable when we gave the process the time broadcasters realistically required. We tripled the process time from 2 months to 6 months - this was exceptionally difficult to sell into all i.e. Government, regulator, even broadcasters but we did.
- We also dealt with exceptional sites proactively as they required i.e. Crystal Palace serving London was essentially its own sub work stream with dedicated teams and took 9+ months to agree the specification and costs

f) Issues compound together

- Crystal Palace - the UK's largest (coverage) and most important - transmission site serving London took 9+ months to agree costs on; had feeder installations that failed; "large" radio stations unaccepting of service outages and power downs; had to be planned in coordination with France; and then had to be bought forward by several months to before the Olympics at the request of the UK Prime Minister. All of these issues (along with many other risks/issues) had to be managed together in synch.
- This is a great example of complexity. Diverse and disparate components act or occur independently yet in doing so create/make decisions that interact and impact each-other, and that this decisions evolve over time - the program is complex because it is adaptive and emerges

10. Promoting a strong future for broadcast terrestrial TV

A repack program that facilitates industry innovation and minimizes ongoing viewer impacts would create opportunities to promote a strong future for broadcast TV. The repack program presents an opportunity for broadcasters to consider the adoption of innovations in the way that they use spectrum. Such innovations can promote spectrum efficiency while at the same time creating opportunities for broadcasters to launch new services thereby underpinning the future of the terrestrial television platform. Reimbursement and transition policies should be sufficiently flexible to sort out reimbursable costs and allow a participating broadcaster to apply the reimbursements to upgraded facilities.

It is paramount that the broadcasters have all options available to achieve greater spectral efficiency within the remaining RF spectrum allocated to television broadcasting, and to continue to present new and exciting methods of delivery to the viewing public coupled with the highest standards of video and audio quality. At this stage we are primarily referring to ATSC 3.0 but also the sharing of infrastructure, multiplexing and spectrum.

To provide an environment in which broadcasters have confidence to work together to implement the repack and explore the opportunities for implementing innovation is critical to guarantee and promote a strong future for broadcast terrestrial TV.

11. Conclusion

Transmit agrees that a transition plan must be phased; with stations assigned within those phases and the phases scheduled, and that the phasing and structure of the program should respond to the objectives and constraints of the program. We acknowledge the technical achievement of the phase scheduling tool and phase assignment tool but stress that their outputs must be considered the (strong) beginning of a transition planning process that will require human expert intervention to be refined and optimized to ensure the repack can be delivered on time, within budget whilst meeting the needs of all stakeholders. Only humans, experienced repack experts and spectrum-planning experts can take a pragmatic and “real world” approach to interference and transition planning – this cannot be built into software. We strongly propose that opportunities be taken to ease the program by embracing and proactively managing interference, and the transition planning process itself – transition planning is in effect a tool itself.

We strongly advocate – from our experiences on other repack programs - adopting a much more pragmatic approach to interference and planning (and with neighboring administrations). The FCC should consider assessing the shortest route through the repack program with the minimum linkage between stations. The objectives of the program are best considered as critical success factors and the constraints must be “real constraints”. Strict aspirations to control the number of phases and the size of phases – whilst a good starting point - can artificially overcomplicate the repack.

Transmit advocates that for the repack to be successful the transition plan must be considered an iterative process – it is optimistic to think that the first channel re-assignment and transition plan will be fit for purpose to deliver the repack and the reality of the repack as its demands emerges. It is, therefore, essential that a “transition management team” leads a proactive and coordinated approach, that this approach has the consensus of the broadcast industry and that there are agreed mechanisms by which program and industry wide decision-making can be facilitated.

It is critical for the success of the reengineering program that “real constraints” are accepted (with broadcast industry consensus) and factored into the planning and implementation process (*i.e.*, bad weather, difficult geographical terrain, limited technical resources, complex engineering at individual and key stations) building in upfront contingency. Only by accepting these limitations up front can you begin to understand how to approach the Repack and unlock the challenges it represents.

A phased and coordinated planning and delivery approach to the complexities of this spectrum repack is essential. It is important to embrace that repack planning is an iterative process. It can only be done in this way. The planning of a repack is essentially a huge, multidimensional puzzle that evolves over time. Spectrum and roll-out planning needs continuous and integrated management through the life cycle of the program, and it needs to be able to adapt and evolve as the program becomes clearer - this is the real task of the “transition management team”. Program strategy, structure and processes will need to be able to handle this iterative nature and feedback loops - this will be the norm not the exception.

Transmit is well placed to provide further expert advice on repack transition management. We would welcome the opportunity to discuss our comments with the FCC and other interested parties.

Respectfully submitted,

TRANSMIT CONSULTANCY



October 31, 2016

Appendix 1: Transmit Management Team

Jules Howard-Wright BSc (Hons) Principal Consultant & Co-Founder

From 2006 to 2012 Jules was Broadcast Project Director at Digital UK for the Digital TV Switchover and 800MHz repacking programs. As Broadcast Project Director, she managed the technical planning, co-ordination and stakeholder management for the re-engineering of the entire UK television transmission network. During 2011 and 2012, Jules also led the technical operations and development of the UK's terrestrial platform Freeview on behalf of multiplex operators.

Jules has worked in broadcasting at an industry level for close to 15 years and has delivered technical projects (TV, internet and mobile) her whole career. Her career started as a producer at digital communications agency Digitas LBi, after which Jules spent a year with a New York dot.com and 3 years as a Commercial Manager at a broadcast consultancy and production house. In 2004, Jules started her first consultancy; her first client was BSkyB where she led the team responsible for launching all broadcasters' interactive services on the Sky platform.

Jules has managed engineering, program and project management teams in New York; managed TV content license holders in LA, Sydney & Tel Aviv; and delivered projects in the USA for Comcast and DirecTV. At the beginning of her career, Jules produced the world's first e-commerce interactive TV application for a major UK retailer.

In 2012 – for her work on UK repacking - Jules was a Women of the Year Finalist in the Cisco everywoman in Technology Awards.

Selected Projects

- **Digital TV switchover:** Leading the technical planning, co-ordination and stakeholder management for the end-to-end re-engineering of the entire UK transmission network.
- **Launching DVB-T2:** Leading the industry restructuring of 6 muxes to enable 1 mux to become DVB-T2, coordinating the rollout of the DVB-T2 mux alongside digital TV switchover.
- **Enabling 4G/LTE rollout and 800 MHz clearance:** Leading the technical planning, co-ordination and stakeholder management for a second re-engineering program running concurrently to the switchover – yet with no impact to the switchover program.
- **DTT platform management:** Responsible for day-to-day operational and technical management of the DTT platform, including the EPG. Leading on platform technical and strategic reviews, working with broadcast partners and industry.

Education

- London Business School, Executive Education - Developing Strategy for Value Creation
- London Business School, Executive Education - Executing Strategy for Results
- Chartered Institute of Personal Development, Postgraduate Cert – Psychology of Management
- Coach U, Graduate - Advanced Executive Coaching
- BSc. (Hons) in Management Studies, University of London

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Mike Hughes BSc (Econ) (Hons)

Principal Consultant & Co-Founder

From 2005 to 2012 Mike was Broadcast Director at Digital UK for the Digital TV Switchover and 800MHz repacking programs. As Broadcast Director, he led the technical planning, co-ordination and stakeholder management for the re-engineering of the entire UK television transmission network.

From 1997 to May 2013, Mike was General Manager of Digital 3and4, a multiplex license holder and a joint venture between ITV and Channel 4. He played a key role in the launch of UK's terrestrial platform Freeview (and its predecessor OnDigital), for many years he chaired the Board responsible for the technical strategy and operations of this platform.

He started his career in industry relations working for the Independent Television Companies Association in the UK and then the Australian Broadcasting Commission in Sydney. He returned to the UK to Anglia Television (part of ITV) rising to Deputy CEO. In 1995, Mike formed his first broadcast consultancy; his first major client was Channel 5 where he acted as Project Co-ordination Director for launch.

Selected Projects

- **Digital TV switchover:** Leading the technical planning, co-ordination and stakeholder management for the end-to-end re-engineering of the entire UK transmission network.
- **Launching DVB-T2:** Leading the industry restructuring of 6 muxes to enable 1 mux to become DVB-T2, coordinating the rollout of the DVB-T2 mux alongside digital TV switchover.
- **Enabling 4G/LTE rollout and 800 MHz clearance:** Leading the technical planning, co-ordination and stakeholder management for a second re-engineering program running concurrently to the switchover – yet with no impact to the switchover program.
- **DTT platform management:** Responsible for day-to-day operational and technical management of the DTT platform, including the EPG. Leading on platform technical and strategic reviews, working with broadcast partners and industry.

Education

- BSc. (Hons) in Economics, London University

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Appendix 2: Transmit Lead Consultants

Mark Evans CEng, MIET, BSc (Hons) Principal Technical Consultant

Mark is a transmission, spectrum management and TV reception expert. From 2005 to mid- 2013, Mark was the lead Technical Consultant at Digital UK for the Digital TV Switchover and 800MHz repacking programs. These roles included representing broadcasters at international spectrum negotiations. Now these programs are complete, Mark continues to consult to Digital UK, working primarily on spectrum related matters including the new 700MHz repacking program, Dynamic Spectrum Access, including TV White Space, and 4G/LTE co-existence. Mark also chairs the cross-industry DTT Platform Steering Group, under the umbrella of the Digital Television Group (DTG), with responsibility for maintaining and developing the 'D-Book'; the detailed technical standards for DTT in the UK.

Mark played a key role in the development and implementation of DTT from 1997, including the negotiation of the transmission contract, and subsequently was a key member of the Freeview launch team in 2002.

Mark has worked in broadcasting for 30 years and provided industry level technical leadership in digital broadcasting since the very beginning. Mark started his career in the BBC's engineering division, project managing the procurement and installation of Long, Medium and Short Wave transmitters and antenna systems in the UK and overseas. He subsequently installed the world's first digital radio network, starting with the research pilot in 1993 followed by the operational network in 1995. Mark remained with the BBC when BBC Transmission was privatized, establishing and leading the team responsible for managing all the contracts for delivering the BBC's services, both radio and television, over terrestrial, satellite and cable, rising to Head of Technology for Distribution with responsibility for all of the delivery of the BBC's services from transmission to reception.

Mark is also considered a leading expert on the potential impact of 4G rollout, White Space and Dynamic Spectrum Access initiatives on DTT reception.

Selected Projects

- **Digital TV switchover:** Technical consultancy for the technical planning, co-ordination and stakeholder management for the end to end re-engineering of the entire UK transmission network.
- **Launching DVB-T2:** Technical consultancy for the restructuring of 6 muxes to enable 1 mux to become DVB-T2, coordinating the rollout of the DVB-T2 mux alongside digital TV switchover.
- **Enabling 4G/LTE rollout and 800 MHz clearance:** Technical consultancy for the technical planning, co-ordination and stakeholder management for a second re-engineering program running concurrently to the switchover – yet with no impact to the switchover program.
- **700MHz:** Technical consultancy for the technical planning, co-ordination and stakeholder management for the 700MHz spectrum repacking program, currently scheduled to complete by 2022.
- **DTT platform management:** Chairs the cross-industry DTT Platform Steering Group, under the umbrella of the Digital Television Group (DTG), with responsibility for maintaining and developing the 'D-Book'; the detailed technical standards for Broadcast DTT in the UK. Sits on operational & technical working groups for the UK's Broadcast DTT platform.

Education and Professional Qualifications

- BSc. in Physics, University of London
- Chartered Engineer and Member of the Institute of Engineering and Technology

Pete Ansell MIEEE, MCMI, MIOD

Principal Technical Consultant

As a broadcaster, representing the many program providers on the SDN multiplex (owned by ITV), Pete played a significant role in UK Digital Switchover and 800 MHz clearance being involved in cross-business debates and decision-making. As such, he was a signatory to all broadcast processes and milestones. His experience covers a wide range of broadcast-related technologies including but not limited to aspects of terrestrial and satellite television transmission, digital television techniques including compression, platform/service management and navigation.

As CTO at SDN, he was responsible for the long-term technical and strategic development of the multiplex. This involved numerous aspects of broadcast technologies relating to a system employing multiple day-part service scheduling including free to air, obfuscated and encrypted services. Further, he has the abilities to bridge the technical and commercial disciplines encountered within the industry.

Pete has worked in the broadcasting industry throughout his professional life. An engineer, he spent eighteen years with the Independent Broadcasting Authority (at the time the UK's regulator). Upon privatization of the engineering division he then joined NTL where he remained for ten years. During that time, Pete designed, built and installed the initial satellite pay TV system for United Artists Programming whose services subsequently became part of the original Sky DTH services line-up on Astra.

He also led the NTL technical team dealing with encryption that supported the "world first" terrestrial pay-TV platform – OnRequest. He subsequently achieved the role of Chief Engineer with technical responsibility for delivering system integration for one of the UK commercial multiplexes. Pete left NTL in 2001 to join SDN.

Selected Projects

- **Digital TV switchover and 800 MHz clearance:** Leading and representing SDN's business and technical interests through the technical planning, co-ordination and roll-out of Digital TV Switchover and the 800MHz Clearance project.
- **DTT platform management:** Leading and representing SDN's business and technical interests on the UK DTT Platform's Management Board, Technical Governance Group and technical working groups.

Education and Professional Qualifications

- HND Electrical Engineering, Southampton College of Technology
- Member Institute of Electrical and Electronics Engineers MIEEE
- Member Chartered Management Institute MCMI
- Member Institute of Directors MIOD

Peter Heslop BSc CEng FICE

Principal Infrastructure Consultant

Peter was Arqiva's Program Director for the UK's Digital Switchover (DSO) & the 800 MHz repack from inception in 2005 until its successful conclusion in 2012. Peter has worked for Arqiva, the company that owns and operates all of the terrestrial TV sites and infrastructure in the UK, for over 35 years. Under his leadership, every one of the 15 DSO regions transitioned on time, within budget, and to the delight of broadcasters, viewers and the UK Government. Overall costs of the program were optimized by re-use (including extending and strengthening where necessary) of existing towers and transmission equipment where possible. Existing analogue and low-power broadcast services were maintained without significant interruption right up to midnight on cutover day. The later stages of the program required a significant re-plan to accommodate the new requirements for 800MHz clearance.

Between 2014 – 2015, Peter was Engineering, Implementation & Operations Director for Smart Metering and Machine to Machine ("Internet of Things") at Arqiva.

Peter is also a consultant to the Steering Group for the forthcoming 700MHz repack in UK.

Earlier in his career, as Director of Asset Management for NTL Broadcast, Peter was responsible for transforming the management, maintenance, documentation and development of all site based physical infrastructure throughout the UK including towers, antenna systems, power and environmental systems, buildings and security. The role was instrumental in the cost-effective utilization of existing sites for new services and applications including TV, Radio, mobile phones, emergency services and all associated backhaul and distribution.

By profession a civil and structural engineer specializing in masts and towers, his early career centered on the design, construction, strengthening and ongoing management of TV towers. He served on the drafting panel for the current UK codes for mast and tower design, and has been an active member of the IASS (International Association for Shell and Spatial Structures) since 1995. Peter has played significant roles in every major terrestrial broadcast and telecoms infrastructure program of recent years in the UK.

Selected Projects

- **Digital TV switchover and 800 MHz clearance:** Leading the detailed technical design, costing, planning and implementation of all site-based infrastructure required for the TV DSO in UK.
- **Launching DVB-T2:** In parallel with DSO, leading the delivery of DVB-T2 muxes.
- **Enabling 4G/LTE rollout & 800 MHz clearance:** Significant replan of later stages of DSO implementation to deliver 800 Clearance in shortest possible timescale, enabling 4G/LTE spectrum auction.
- **700MHz:** Member of 700MHz Clearance Steering Group, advising on infrastructure program, risk management, procurement strategy, resourcing and communications

Education and Professional Qualifications

- BSc Civil Engineering, University of Manchester
- Chartered Civil Engineer, Fellow of the Institution of Civil Engineers
- Member of BSI drafting panel for current design codes for structural design of masts and towers
- Member of IASS (international Association for Shell and Spatial Structures) WG4 the worldwide collaboration group for the development of mast and tower design

Appendix 3: Transmit's comments filings to the FCC regarding Docket No. 12-268: Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions

April 21 2014

Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions; Docket No. 12-268 and Public Notice: **Media Bureau Seeks Comment on Widelity Report and Catalog of Potential Expenses and Estimated Costs**, March 2014, DA 14-389

apps.fcc.gov/ecfs/document/view?id=7521098978

March 17 2014

Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions; Docket No. 12-268 and Public Notice: **Office of Engineering and Technology Seeks to Supplement the Incentive Auction Proceeding Record Regarding Potential Interference between Broadcast Television and Wireless Services**, January 2014, DA 14-98

apps.fcc.gov/ecfs/document/view?id=7521093434

October 31 2013

Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions; Docket No. 12-268 and Public Notice: **Media Bureau Seeks Comment on Catalog of Eligible Expenses and Other Issues Related to the Reimbursement of Broadcaster Channel Reassignment Costs**, September 23, 2013, DA 13-1954

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